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A NEW SOVIET DEFIBRILLATOR

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In connection with the more extensive application of chest surgery, particularly in cardiac operations, the necessity arises of counteracting the fibrillation of the heart. This complication, which leads to a rapid death of the patient, sometimes occurs even when hypothermia is applied.

Experimental investigations and observations carried out by clinicians have shown that the most effective method of eliminating this serious complication is applying an electric current to the heart. Foreign scientists on purely empirical grounds use an alternating current for this purpose. However, when this current is applied, a danger may arise to the personnel. Furthermore, under certain conditions an alternating current may itself bring about a fibrillation of the heart. For the reasons stated, the American investigators Wiggers and Beck proposed that the potential of the alternating current be restricted to that of the lighting current network, i.e., 110-135 volts. This potential is sufficient only when the electrodes are placed directly on the heart, so that an incision into the chest must be carried out.

At the laboratory of Experimental Physiology on the resuscitation of the Organism, Academy of Medical Sciences USSR, a prolonged investigation has been carried out on the process of fibrillation and the conditions which are needed for terminating the fibrillation (i.e., effecting a defibrillation). It has been established that defibrillation takes place as a result of the ordinary stimulating effect of the electric current on the heart. It has been furthermore established that prolonged application of an alternating current is inadvisable. It is better to apply a single electric impulse having a duration of about 0.01 second, which is the time that corresponds to the so-called useful period of the stimulation of the cardiac muscle. A stimulus of this kind is effective at the minimum duration and current strength of the applied current and is not accompanied by harmful results, which are observed when the heart is exposed to the action of the current for a longer period (up to 0.5 second).

The factor of safety connected with the application of a single impulse makes it possible to apply a higher potential for the defibrillation of the heart by placing the electrodes on the surface of the chest. This method of application makes it possible to use an electric current outside of the walls of the surgery for rendering aid in injuries caused by electric currents or drowning and conditions arising as a result of some cardiac diseases. The study of the pathophysiology of terminal conditions has shown that defibrillation can be included in the complex of measures applied in V. A. Negovskiy's method of resuscitation. In such cases, the possibility of defibrillating the heart rapidly without an incision into the chest contributes to the effectiveness of the aid rendered to the victim.

N. L. Gurvich, Associate at the Laboratory of Experimental Physiology on the Resuscitation of the Organism, and A. N. Akopyan and I. A. Zhukov of the All-Union Electrical Engineering Institute imeni V. I. Lenin, have designed a special apparatus called the defibrillator. This apparatus generates single electrical impulses, which represent discharges of a definite wave form and duration emanating from a condenser. The condenser of the apparatus can be charged up to a potential of 6,000 volts, so that defibrillation can be carried out without making an incision into the chest. When operations are carried out on the organs of the chest and the electrodes therefore can be applied directly to the heart, a potential not exceeding 2,000 volts is sufficient.

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The defibrillator designed in the USSR has a number of advantages as compared with similar equipment used for this purpose abroad: it is safe in use, does not exert any harmful effects on the heart, and makes it possible to accomplish a defibrillation of the heart without making an incision into the chest.

The first units of the new equipment are already in use at the major surgical clinics. The Presidium of the Academy of Medical Sciences USSR has approved the new apparatus.

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